~~UNDERGRADUATE MATH SEMINAR~~ Steinmetz Symposium!

In deference to the annual Steinmetz Symposium being held on **Friday, May 10**, there will not be a separate math seminar this week. Instead, we encourage you to attend the math and math-related talks that will be presented.

Session 1 Math and Computer Science, ISEC 118

- **8:30, Olivia Gwinnett,** Linear Codes and Their Properties: *This project aims to highlight connections between branches of theoretical math and their applications to cryptography. In this case we are looking at how Galois geometries can be applied to coding theory. We will introduce the concept of linear codes with an emphasis on the subset of Reed-Solomon codes. These codes are important in error detection and correction.*
- **8:50, Emily Vasquez**, Finding the Relationship Between Triangles and the Pythagorean Theorem Using Calculus: *The Pythagorean Theorem can be proven in many different ways using different fields of math. In this talk, we will discuss one proof that utilizes techniques from (multivariable) calculus to show a triangle is a right triangle if and only if the triangle's sides,* a, b, *and* c, *satisfy the Pythagorean identity* $a^2+b^2=c^2$.
- **9:10**, **Mayah Teplitskiy**, Elliptic Curves and Diophantine Stability: *In 2023, Ray and Weston defined the notion of diophantine stability at ℓ for an elliptic curve* $E_{/K}$ *defined over a number field* K *and a prime ℓ. We provide a brief discussion of Galois theory and algebraic number theory, while building up intuition and implications for possible answers to the following question: For a fixed elliptic curve* $E_{/K}$ *and a fixed prime* $\ell > 3$, *what number fields* K *allow* $E_{/K}$ *to satisfy the property of being diophantine stable at ℓ?*
- **9:30**, **Uri Tomer**, Newton Polygons of Polynomials Composed with Eisenstein Polynomials: *We construct the field of p-adic numbers and discuss some of its properties. We then introduce the concept of a Newton polygon of a polynomial with coefficients in* Z_p *We prove a theorem about the Newton polygon of a one segment Newton polygon, f, composed with an Eisenstein Newton polygon, g. The theorem states that the Newton polygon of* $f \circ g$ *is the Newton polygon of f stretched by a factor of the degree of g. Finally, we discuss a conjecture about the Newton polygon of* $f \circ g$ *if f has more than one segment. The conjecture states that the Newton polygon of* $f \circ g$ *will again be stretched by a factor of the degree of g. We provide some evidence to support this conclusion.*
- **9:50**, **Diep (Emma) Vu**, How Can the Fast Adaptation of Cross-Accented Speech Recognition Architecture Help Virtual Assistants Mitigate Racial Bias? *My project aims to address the challenge of accent speech recognition and racial biases in Automatic Speech Recognition (ASR) systems, specifically focusing on African American Vernacular English (AAVE). In particular, this research explores the potential of fast adaptation techniques by utilizing a Transfer Learning approach to enhance the performance of transformer models in recognizing accents and dialects not adequately represented in the training data. By using the Corpus of Regional African American Language (CORAAL), my approach involves meticulously cleaning and extracting features from the dataset to prepare it for thorough training and testing of an ASR model trained on a large-scale dataset, DeepSpeech by Mozilla. The performance evaluation, based on the Word Error Rate (WER) metric, compares the model's accuracy. Overall, the average WER for the CORAAL dataset running with pre-trained DeepSpeech is at 25.89%, which is higher than the ground truth for Standard American English at 11.82%, with the outlier from Lower East Side, New York (LES) in CORAAL region at 65.94%. The results of this project not only have the potential to significantly contribute to the advancement of more accurate and unbiased ASR systems but also provide valuable guidance for mitigating racial biases in Natural Language Processing (NLP), thereby fostering a fair and equitable application of ASR technology.*

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Fall Term Preregistration: Advising, Pre-Approval, Begin this Week

Even though we are just halfway through the spring term, it is already time to start thinking about fall term course scheduling, advising meetings, and "Pre-Approval".

The timeline for advising, Pre-Approval, and fall term registration is as follows:

- **Weeks 6, 7, and 8** – students meet with their Academic Advisor and obtain registration clearance.
- **May 15**: Pre-Approval surveys are due from students.
- May 20: Departments submit lists of pre-approved students by course to the Registrar for enrollment.
- **May 27**: Regular registration period begins.

For the Fall 2024 term, **six math courses require pre-approval:**

MTH 105, 110, 113, 117, 197, and 199

You must complete this form to seek preapproval for these math courses.

The complete list of courses across the college that require pre-approval can be found at https://www.union.edu/advising-registration/pre-approval-courses.

Courses beyond calculus: This fall, the Math Department will be offering several interesting courses beyond the calculus sequences that are suitable for math majors and minors.

- **Math 199** is the department's "bridge course," intended to help students make the transition from computationally oriented courses to more theoretical proof-writing courses. This is a **required** course for all math majors and minors that is *usually* taken after Math 115.
- **Math 219 – Discrete Mathematics**. In this course, topics studied may include graph theory, partially ordered sets, the Four-Color Theorem, and more. As a 200-level course, Math 219 is appropriate for students coming from Math 199, as well as more advanced students.
- **Math 227 – Financial Mathematics**. We will apply mathematical concepts to calculating present and accumulated values for various streams of cash flows. We will learn the terminology associated with these calculations including simple and compound interest, discount, and force of interest. We will examine various financial instruments including annuities, loans, bonds, stocks and interest rate swaps, and how these instruments can be used to solve various needs. The focus of the class is on being able to solve problems and perform relevant calculations. Prerequisites: ECO 101 and (MTH 112 or MTH 113).
- **Math 235 – Number Theory**. This course studies properties of the integers, including divisibility, prime numbers, congruences, special number theoretic functions, and quadratic reciprocity. Note that students generally may not take both Math 221 and Math 235 (Number Theory) – choose wisely!
- **Math 336 – Real Variable Theory** is a core course that is **required** for math majors. In this course, you will learn some of the theoretical underpinnings of the calculus of functions whose domain lies within the set of *real* numbers.

ReUnion Weekend, Friday, May 17, 4:00 – 5:00pm
Math Department Reception: Bailey 204 (Math Common Room)
Enjoy a casual reception and light refreshments with alumni who majored in math.